PRODUCTIVITY IMPROVEMENT OF FISH CRACKERS PROCESSING USING SIMULATION TECHNIQUE

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ABSTRACT

Fish cracker is one of the famous foods that originated from East Coast of Malaysia consists of Terengganu, Kelantan and Pahang. It is mainly made from mixing of sago flour, fish, egg, salt and water. Up today, fish crackers are traditionally produces by small industries that not acquire the good practices and latest technology. Therefore, this industry has a lot of inadequacy to expand due to low productivity and unreliable production management. Looking into this issue, the purpose of this study is to determine optimum process layout configuration fish crackers factory using computer simulation analysis. This study adopts industrial engineering concept to help the entrepreneur of fish crackers to increase their productivity. Generally, this layout planning is involving the overall process of fish crackers production. Study started with identification all the process and the types of fish crackers production. Then, process variables such as customer requirement and function of the entire machine are being defined and the time production for all processes is being taken. The process continued with some of the layout being created using WITNESS Software for the all process that involve in the production of fish crackers. Based on the purpose outlined, suggestion and recommendation for improvement has been proposed. Upon completion of this study, it can be applied by the entrepreneurs who seriously involved in the fish crackers manufacturing industry to fulfill the market requirement.

ABSTRAK

Keropok ikan adalah salah satu makanan terkenal yang berasal dari Pantai Timur Malaysia iaitu Terengganu, Kelantan dan Pahang. Ia dibuat daripada campuran tepung sagu, ikan, telur, garam dan air. Sehingga hari ini, keropok ikan yang secara tradisinya dihasilkan oleh industri kecil tempatan belum mempunyai teknologi terkini. Oleh itu, industri ini mempunyai had yang terbatas untuk dikembangkan kerana produktiviti yang dihasilkan rendah dan pengurusan pengeluaran tidak boleh dicapai. Melihat kepada isu ini, tujuan kajian adalah untuk menentukan proses susun atur yang optimum pada kilang keropok ikan dengan menggunakan analisis simulasi WITNESS di dalam komputer. Kajian ini menggunakan konsep kejuruteraan perindustrian dan mengkaji penemuan ini untuk membantu usahawan keropok ikan meningkatkan produktiviti mereka. Secara umumnya, ini perancangan susun atur yang melibatkan keseluruhan proses pengeluaran keropok ikan. Kajian bermula dengan pengenalan semua proses yang terlibat dan jenis pengeluaran ikan keropok. Kemudian, spesifikasi seperti keperluan pelanggan dan fungsi keseluruhan mesin dijelaskan dan pengeluaran masa untuk semua proses diambil. Proses ini dijalankan dengan beberapa susun atur yang dicipta menggunakan Perisian WITNESS untuk semua proses yang terlibat dalam pengeluaran keropok ikan. Berdasarkan kepada tujuan yang digariskan, cadangan dan syor untuk penambahbaikan akan dicadangkan sebagai peningkatan berterusan kepada peningkatan pengeluaran. Setelah selesai kajian ini, ia boleh digunakan oleh usahawan yang serius terlibat dalam industri pembuatan keropok ikan untuk memenuhi keperluan pasaran.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This chapter provides information about background of study, problem statement, objectives, scopes of work and benefits of the project. Besides that, this chapter also include about the outline of the project.

1.2 BACKGROUND OF STUDY

Small and Medium Industries (SMI's) now are playing significant contribution in the economics of development, social uplifting and political stability of Malaysia. SMI's now can be established for any kind of business activities either in urban or rural area. It also can be considered as the back bone of national economy nowadays. Due to significant contribution of SMI's towards the development of the economy, various agencies now have given a lot of importance on the development of SMI's. There are lots of activities and facilities were being provided to strengthen and enhance their performance and competitiveness. To strengthen and enhance the SMI's industry, the productivity of the industry must be the most important thing to always being observed.

The productivity for SMI's industry depends on how much the production they can be produced either based on day or every week even for every month. Basically, for SMI's industry, their production is not fixed day by day. It depends on the workers, and also depends on their customer demand. In addition, productivity also measures the relationship between outputs such as goods and services provided, and inputs that include the labor, capital, material, and other resources. The two more specific types of productivity measured are the labor productivity measuring outputs in terms of hours worked or paid for and the total factor productivity was including the cost of equipment, energy, material and the cost of the labor.

Figure 1.1: Figure shows some of The Process in the fish crackers Factory.

The project that has been used in this study is about the productivity improvement for SMI's in keropok ikan production. Fish crackers are one of the popular and highly relished fish products in Malaysia especially for east coast

area of peninsular Malaysia like in Pahang, Terengganu and Kelantan. It is the specialty most from Terengganu, and omnipresent in the streets and villages and very much a part of the live of the people there. Fish crackers demands have been increasing day by day nowadays and it is widely sold in the local market and usually produced on a daily basis to fulfill the market demand, especially for school canteens, night markets and hawker stalls. At present, most of Fish crackers manufacturers carry out the processing manually, following established procedures with little mechanization.

Nowadays, SMI's products have been spread widely and become popular rather than well-known imported product. Fast foods like nugget, burger, frankfurter, and fish ball are imported or very hard to find in the market but currently can be easily found. The development of SMI's also was influenced many local foods such as Fish crackers, otak-otak, and many confectionary products to be commercialized. Therefore, SMI's entrepreneurs need a better machine to increase their productivity in order to fulfill market requirement. Unfortunately, special machine to automate the process in SMI still not widely used. .

In this study, two main aims are to identify current production time for processing fish crackers and the simulation study of the process automation for the keropok production.

1.3 PROBLEM STATEMENT

Fish crackers, is a popular snack based on fish, is usually molded from kneaded fish meat and dough. Usually, fish crackers is processed traditionally with application certain mechanical equipment such as mixer and mincer. Meanwhile degutting and deboning of the fresh fish is done manually, the job to

roll the kneaded fish meat is also done manually. Boiling the water for boil the fish crackers also being done manually and it takes more times to be waited. Other than that, fish crackers itself should be cool down the temperature after being boiled also is done manually. The cutting process to smaller size also done semi-manual since no proper machine available in the market.

The high requirements of fish crackers in the market urge entrepreneurs to increase their production but they facing a lot of problem to fulfill market requirement. The entrepreneurs faced a problem to increase production volume because a lot of process in producing fish crackers has been done manually. In manual process and current practice, mass production for fish crackers is not suitable. Material characteristics of fish crackers which is sticky, glutinous, and gummy have influenced to the time taken to cool down the temperature, cut and pack the fish crackers itself. If the entrepreneurs want to increase their production, major of the process should be done in automated way.

Besides, the use of automated equipment compensates for the labor cost disadvantage relative to competitors. More, automations can decreases production cycle times, and increases product quality and consistency. This statement was firmly proved that if the fish crackers entrepreneurs want to increase their product volume, this is the best way to have.

Nowadays, proper study to improve production layout and introduction of good machines that capable to improve fish crackers production still not widely implemented in SMI industry. Thus, fish crackers simulation study should be conducted to assist entrepreneurs to increase their production and improve their manual process to automated process. As a consequence, their volume production will increase and the product itself can be commercialized and exported to worldwide.

1.4 OBJECTIVE

The objectives of this study are:

i. To identify process problems in fish crackers processing.
ii. To simulate current practice in fish crackers processing.
iii. To analyses and propose better process layout for fish crackers processing

1.5 SCOPES OF WORK

In order to meet the objectives listed, the scopes of this project have been defined. There are:

i. Data collection to determine current processing time for one type of fish crackers.
ii. Conduct simulation analysis on the proposed of process layout using WITNESS Software.
iii. Identify suitable production layout can be implemented in industry.

The study is involved in development of automated the process in the industry that will be used to production of fish crackers into specific size and uniform shape required by the customer. The entire layout process consists of three mechanisms which are for three types of keropok which is rectangle keropok, big long keropok and small long keropok. All the mechanisms probably are automated, because that is one of the objectives of this study. Upon a completion of this study, feeding mechanism will be implementing using the conveyor while the layout mechanism will be done using witness software system.

1.6 BENEFITS OF THE PROJECT

There are a few benefits of this project either directly or just influenced by this new invention. The benefits are:

i. University as a learning center has done their responsibility in implementing research and innovation at the specific area thus can be applied for human to increase quality of lifestyle.

ii. Student learned a knowledge about invention of machinery especially which is related to SMI's. Student also gains knowledge to conduct a project with proper procedure and write a thesis in correct format.

iii. The company can adapt and commercialized the research and innovation has been done by university academician via memorandum of agreement (MOA).

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will explain about systematic layout planning, the design, keropok ikan characteristics, the simulation study, and the relationship among them that involve in the implementation of this project. Generally, this chapter focused on a single question which tries to identify, appraise, select and synthesize all the high quality research evidence that relevant to this project.

2.2 DESIGN

Technical design focused on the development of a product or process. Generally, design can be divided into conceptual design and detail design, which categorized under engineering design.

2.2.1 Engineering Design

Engineering design is the systematic, intelligent generation and evaluation of specifications for artifacts whose form and function achieve stated objectives and satisfy specified constraints (Dym and Lewit., 1991). Besides, engineering design has been defined as the process of applying the various techniques and scientific principles for the purpose of defining a device, a process or a system in sufficient detail to permit realization (Norton, 1999). He also stated that design may be simple or enormously complex, easy or difficult, mathematical or nonmathematical which may involve a trivial problem or one of the great importances.

Meanwhile, according to Madara & Kremer (2004), engineering design is the application of technical knowledge with knowledge of from non-technical disciplines and the use of design and analysis tools to synthesize a product or system that solves a particular problem or meet a specific need. Both academicians also agreed with the statement of The US Accreditation Board for Engineering and Technology (ABET, 1995) which identifies engineering design as the process of deriving a system, component, or process to meet desired need. It is a decision making process (often iterative), in which the basic sciences, mathematics, and engineering sciences are applied to convert resources optimally to meet a stated objective. Among the fundamental elements of design process are the establishment of the objectives and criteria, synthesis and analysis, construction, testing and evaluation.

Further, engineering design is entailed to include a variety of constrains such as economic factors, safety and reliability, aesthetics, ethics and social impacts. Researches about engineering design have been conducted by many scientists who have successfully identified and classified the design category in very detail.

2.3 PRODUCTION SYSTEM

In production management system, all activities are properly planned to accommodate process requirement and production floor layout. A well-known solution approach for the layout problem is the Systematic Layout Planning (SLP), which is developed in the early 1970s by Muther (Muther 1973), is by far the most popular facility design approach in practice. A primary reason the SLP technique has remained popular for more than 30 years is its simple step-by-step approach to facility design (Tompkins, White et al. 2003).

It consists of four phases: determining the location of the area where facilities will be laid out, establishing general overall layout, establishing detailed layout plans, and installing the selected layout. For the second and the third phases are the most important. Establishing the general overall layout involves determining the flow of materials between facilities, examining special adjacency requirements, determining the space required for each facility, balancing it with the space available, incorporating practical constraints (e.g., budget, safety), and generating alternative layout plans (Heragu 1997) as shown in Figure 2.1.

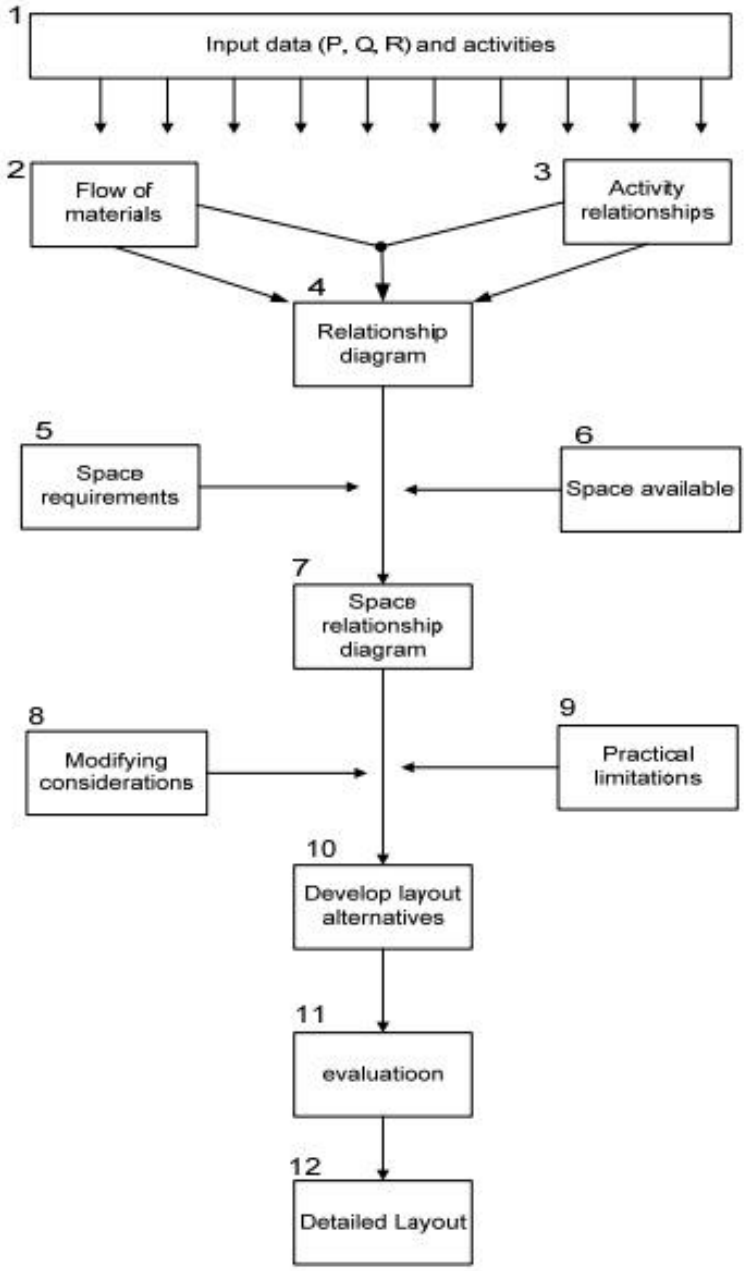

Figure 2.1: The Outlines for SLP Procedure

Source: Muther 1973

From the above figure, it outlines how the SLP procedure is established. It begins with the analysis of data collection fields including P (product), Q (quantity), R (routing), and other to assure the validity of the input data at the design stage. In the flow material analysis (Step 2), all materials flow

from all facilities are aggregated into a from-to chart that represents the flow intensity among departments. The step of ‘activity relationships’ (Step 3) performs qualitative analysis towards the closeness relationship decision among different departments. The Step 4 positions department’s space; those departments that have strong interaction and or closes relationships are placed in proximity. The step of ‘space requirements’ which is Steps 5 and 6 is to determine the amount of floor space to be allocated to each department. The ‘space relationship diagram’ adds departmental size information into the relationship diagram from step 4. Additional design constraints and limitation are considered before the start of block layout generation in Steps 8 and 9. Step 10 then is develops the layout alternatives as design candidates. The next step is Step 11 chooses the final design from these design candidates (Tompkins, White et al. 2003).

Once the relative position of each department is found, Step 12 follows with the detailed layout of the facilities. This includes locating the input or output of the locations, providing the layout and location of specific machines and equipments within the departments, determining the location of the docks in the warehouses, determining the flow of materials between departments, and others.

2.4 KEROPOK IKAN CHARACTERISTICS

Keropok ikan is an important fish product in Malaysia. The customer demands for keropok ikan have been increasing day by day nowadays. Keropok ikan has been known to have a short shelf life of only one day at the room temperature by (Embong et. al., 1990). Che Rohani and Mat Arup (1992) showed that the total viable count of bacteria in keropok ikan increased from less than 1 x 102 cfu/g to 1.5x 108 cfu/g after two days at the room temperature.

Signs of spoilage for this product include sliminess and formation of spots on the surface, which are resulted from the bacterial growth. Thus, a good

understanding of the microbial profile of keropok ikan is vital. Microorganisms gain access into processed meat, from a variety of modes including ingredients, environment, equipment and handlers, during processing. This will definitely affect the microbiological status of the product. Processing conditions such as boiling of product can reduce microbial levels, although recontamination takes place during post-processing and handling of food (Sachindra et al., 2005).

2.5 SIMULATION AND SOFTWARE

Over time, simulation tools have found use in most manufacturing industries. Due to the increased flexibility and openness of the tools available today, simulation can now begin to permeate all facets of the organization beyond the industrial engineering and manufacturing specific factor (Pam Laney Markt and Michael H. Mayer., 1997).

WITNESS software is actually is a true process about the simulation and modeling tool. With WITNESS, the optimization of the manufacturing floor layout, with respect to material flow, and provided by MATFLOW can be further refined. WITNESS is used to simulate about the full production runs, over an arbitrary time period, so that by using the WITNESS software, will allows people to designing a facility to get a glimpse of how the production lines might operate in reality (Pam Laney Markt and Michael H. Mayer.,1997).

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

In this chapter, the research methodology used in the study is being described. The area where the study are being conducted, the study design and the population and sample are also being described.

3.2 FLOW CHART

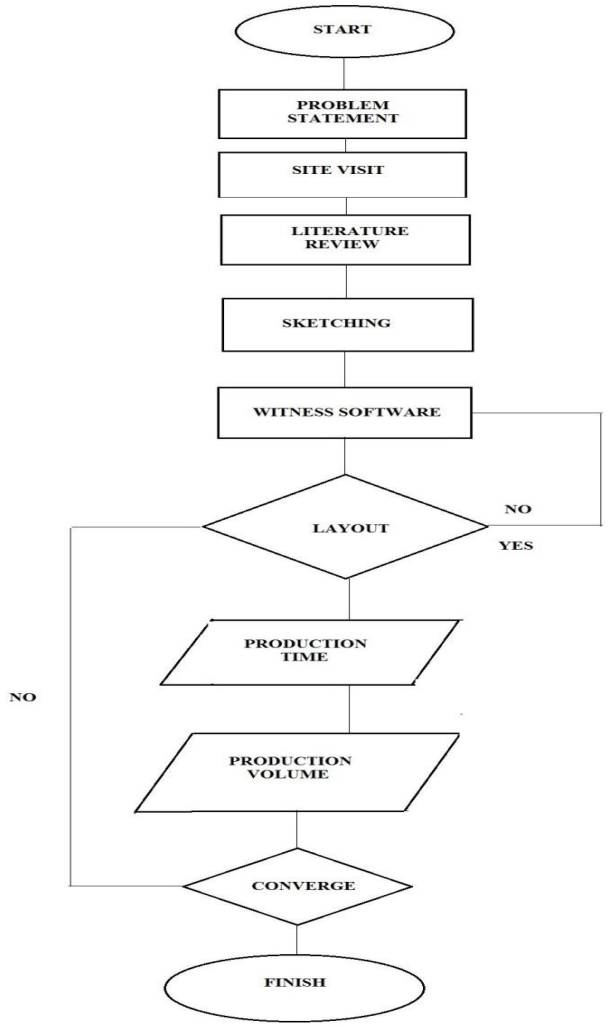

Figure 3.1: Flow chart about full project planning

From the figure 3.1, it shows the research flow in this study. Therefore, all acticvities that was conducted based on the flow chart. For the first step of the study, the problem statement needs to be stated for the case of this project, so that the problem in the current process can be known. After studying the problem that have in the current process, the site visit have been done to know more on the layout of the actual process and at the same time the study on the

literature review also been done. The next step is sketching the layout of actual process in the industry and where the workstation have problems been investigated. It was been continue with sketching the layout in the WITNESS Software and been compared with the actual layout. The studies being continued with the some of the case study that can being improved the production time and volume become well increase for the whole process and types of keropok's. Lastly, all the result that been produced need to be analyses and discusses and the study is more focused on the increasing of the production volume and production time for whole processes.

3.3 IDENTIFY THE PROBLEM

In the week first, the topic for the final year project have been given to student and the problem statement that relate to the topic need to be review. In identify the problem, site visiting have been done to seen face to face what is the problem that being faces by the SMI's factory. Other than that, the site visit also can make my work become easier to finding the problems that they have been facing which can affect the factory production volume.

Site visiting to the factory has been done about two times for at this time to know deeper the problem that the factory facing. From this site visit, the better arrangement layout that suitable with the factory also can be seen.

3.4 PRODUCTION LAYOUT PROPOSAL

After have been done with the site visiting, the layout that can be done in the factory need to be draft and need to be check with supervisor about the layout. For the layout, WITNESS software will be used to sketch the layout for the factory.

The manual sketching of the working layout need to be sketch based on the data got during the site visit. All the machines and equipment that they have in the factory must be placed exactly with the real arrangement in the factory.

3.5 SIMULATION STUDY

After done with the sketching the real layout based on the real situation, the new sketching layout must be done to compare with the old one. All the production time, production volume and others that can affect the production volume must be consider.

After that, the sketching of the layout can be do using the WITNESS software and can be run to see the result for all types of layout. The simulation for both, old and new layout need to be discuss and study.